UPPER SPOTTED DOG CREEK RESTORATION DESIGN

PROJECT OWNER

MONTANA NATURAL RESOURCE DAMAGE PROGRAM
P.O. BOX 201425
HELENA, MONTANA 59620

PROJECT DESCRIPTION

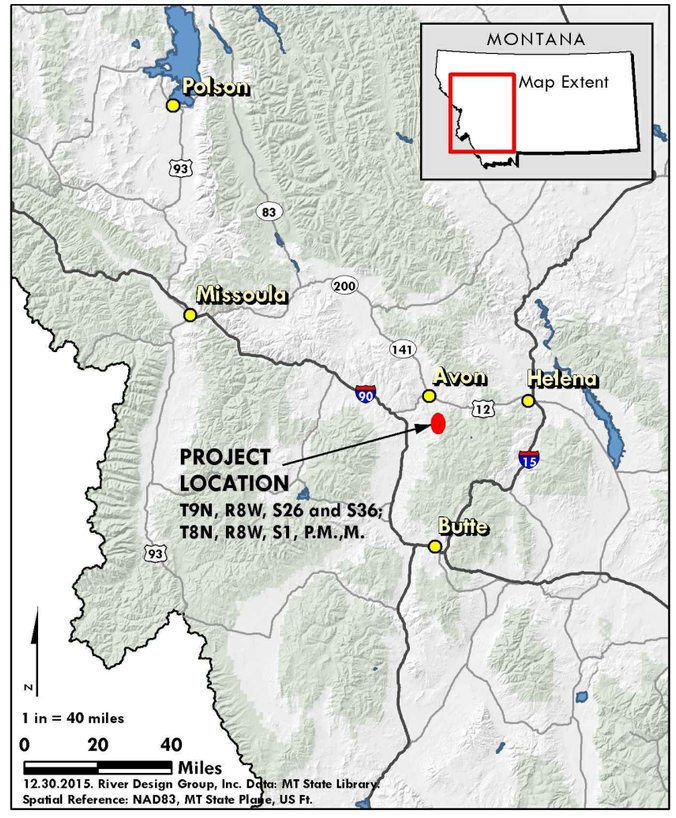
THE LITTLE BLACKFOOT RIVER ALONG WITH TRIBUTARIES SPOTTED DOG CREEK, DOG CREEK AND SNOWSHOE CREEK ARE IDENTIFIED AS PRIORITY AREAS FOR RESTORATION IN THE "FINAL UPPER CLARK FORK BASIN AQUATIC AND TERRESTRIAL RESOURCES PLAN, 2012" PREPARED BY THE MONTANA NATURAL RESOURCE DAMAGE PROGRAM. IN 2014 A RIPARIAN HABITAT ASSESSMENT WAS COMPLETED FOR THE LITTLE BLACKFOOT RIVER AND PRIORITY TRIBUTARIES BY GEUM ENVIRONMENTAL CONSULTING AND RIVER DESIGN GROUP. THE ASSESSMENT IDENTIFIED ACTIVE RESTORATION OPPORTUNITIES IN UPPER SPOTTED DOG CREEK TO ADDRESS DEGRADED RIPARIAN HABITAT AND TO IMPROVE STREAM FUNCTION. THE PROJECT SITE IS LOCATED ON MONTANA FISH, WILDLIFE, AND PARKS LAND APPROXIMATELY 8 MILES UPSTREAM FROM THE CONFLUENCE WITH THE LITTLE BLACKFOOT RIVER NEAR AVON, MONTANA.

GENERAL NOTES

1. THE CONTRACTOR SHALL VERIFY EXISTING CONDITIONS IN THE FIELD PRIOR TO CONSTRUCTION. IF NECESSARY, ADJUSTMENTS TO THE DRAWINGS WILL BE MADE AS DIRECTED BY NRDP AND THE ENGINEER.
2. TOPOGRAPHY SHOWN ON THE DRAWINGS IS BASED ON SURVEY WORK PERFORMED BY RDG IN 2019 AND LIDAR SURVEY DATA COLLECTED IN SUMMER 2015 BY NRDP.
3. UTILITIES IDENTIFIED ON THE DRAWINGS ARE APPROXIMATE AND DO NOT REPRESENT ABSOLUTE HORIZONTAL AND VERTICAL LOCATIONS. THE CONTRACTOR SHALL COORDINATE WITH THE APPROPRIATE UTILITY LOCATE SERVICE PRIOR TO CONSTRUCTION TO IDENTIFY UTILITY LOCATIONS.
4. THE ENGINEER WILL PROVIDE COPIES OF APPLICABLE PERMITS REQUIRED TO PERFORM THE WORK PRIOR TO THE START OF CONSTRUCTION.
5. THE CONTRACTOR SHALL COMPLY WITH ALL SAFETY REQUIREMENTS DESCRIBED IN THE CONTRACT DOCUMENTS.
6. THE CONTRACTOR SHALL PROTECT ALL TREES AND LAND AREAS NOT LOCATED WITHIN THE PROJECT CONSTRUCTION, STAGING OR CONSTRUCTION LIMITS. EXERCISE CARE IN AREAS NOT SO MARKED TO AVOID UNNECESSARY DAMAGE TO NATURAL VEGETATION.
7. THE ENGINEER WILL PROVIDE SURVEY CONTROL AND GRADING SURFACES FOR EQUIPMENT WITH GPS MACHINE CONTROL CAPABILITY. THE CONTRACTOR SHALL PROVIDE SURVEY STAKING AND LAYOUT FOR CONSTRUCTION.
8. VERTICAL TOLERANCE FOR CONSTRUCTION COMPLIANCE WILL BE 0.3 FEET. HORIZONTAL TOLERANCE WILL BE 1.0 FEET.
9. THE CONTRACTOR SHALL CONFIRM QUANTITIES SHOWN ON THE DRAWINGS AND FOR OWNER-SUPPLIED MATERIALS.
10. EARTHWORK QUANTITIES REPORTED ON THE DRAWINGS ARE NEAT LINE QUANTITIES CALCULATED FROM THE DIFFERENCE BETWEEN THE FINISHED GROUND SURFACE AND EXISTING GROUND SURFACE.
11. EARTHWORK QUANTITIES DO NOT INCLUDE SUBGRADE EXCAVATION QUANTITIES UNLESS NOTED OTHERWISE.
12. SLOPES DESIGNATED AS 2:1, 1.5:1, ETC., ARE THE RATIOS OF HORIZONTAL DISTANCE TO VERTICAL DISTANCE.
13. DIMENSIONS ARE GIVEN IN FEET AND TENTHS OF A FOOT.
14. VERTICAL REFERENCE FOR DESIGN LAYOUTS IS THE TOP OF BANK REPRESENTING BANKFULL CHANNEL ELEVATIONS.
15. EXCAVATION, TRENCHING, SHORING, AND SHIELDING SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR PERFORMING THE WORK, THESE DRAWINGS ARE NOT INTENDED TO PROVIDE MEANS OR METHODS OF CONSTRUCTION.

DRAWING INDEX

UPPER SPOTTED DOG CREEK VICINITY MAP



STANDARD OF PRACTICE

PERFORMANCE EXPECTATIONS AND INDUSTRY STANDARDS FOR THE DESIGN OF RESTORATION PROJECTS VARY DEPENDING ON PROJECT GOALS AND THE CONSEQUENCES OF PROJECT FAILURE. BECAUSE RIVERS ARE NATURALLY DYNAMIC SYSTEMS, EXPECTATIONS FOR PROJECT STABILITY CAN BE EXPRESSED IN THE CONTEXT OF DYNAMIC EQUILIBRIUM, WHEREBY PROJECT ELEMENTS AND RESTORATION TREATMENTS ARE EXPECTED TO REMAIN QUASI-STABLE, BUT CHANGE IN AN ECOLOGICALLY BENEFICIAL MANNER AS A RESULT OF DESIRED DISTURBANCES FROM NATURAL RIVER PROCESSES. WHEN PROJECTS ARE BUILT PRIMARILY FOR HABITAT, STABILITY DESIGN CRITERIA ARE SELECTED TO MAXIMIZE DYNAMIC EQUILIBRIUM AND ALLOW FOR NATURAL RIVER PROCESSES TO OCCUR (TYPICALLY A 25-YEAR FLOW/4 PERCENT EXCEEDANCE EVENT OR LESS). WHEN PROJECTS HAVE THE POTENTIAL TO CAUSE DAMAGE OR JEOPARDIZE PUBLIC SAFETY DUE TO FAILURE, STABILITY DESIGN CRITERIA ARE SELECTED TO REDUCE THE RISK OF FAILURE (TYPICALLY A 100-YEAR FLOW/1 PERCENT EXCEEDANCE EVENT, OR GREATER). FOR THIS PROJECT, THE 25-YEAR FLOW HAS BEEN SELECTED FOR STABILITY DESIGN CRITERIA.

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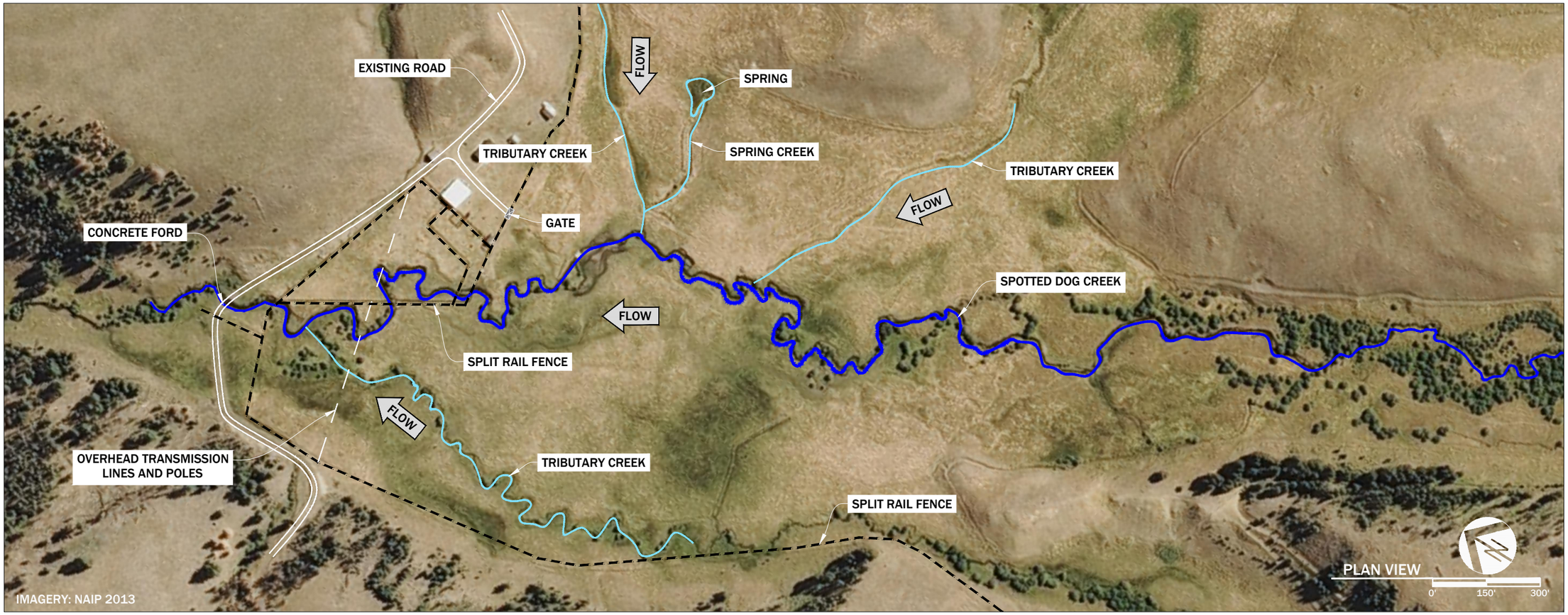
COVER PAGE

UPPER SPOTTED DOG CREEK
NEAR AVON, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	3-11-16	NW	DESIGN	MD
2	1-02-20	NW	DESIGN REVISIONS	MD
3	2-10-20	NW	DESIGN REVISIONS	MD

PROJECT NUMBER
RDG-15-053

SHEET NUMBER
1.0



SPOTTED DOG CREEK EXISTING CONDITION DESCRIPTION

SPOTTED DOG CREEK ORIGINATES AT THE CONTINENTAL DIVIDE AND FLOWS FOR APPROXIMATELY 14 MILES BEFORE ENTERING THE LITTLE BLACKFOOT RIVER NEAR AVON, MONTANA. THE PROJECT SITE IS SITUATED IN THE UPPER HALF OF THE WATERSHED, AND HAS A CONTRIBUTING DRAINAGE AREA OF 13.2 SQUARE MILES. BASIN RELIEF RANGES FROM 7,540 FEET IN THE HEADWATERS NEAR THE CONTINENTAL DIVIDE TO 5,240 FEET AT THE PROJECT SITE. THE WATERSHED HAS A CONTINENTAL CLIMATE CONSISTING OF HOT DRY SUMMERS AND COLD WINTERS. PRECIPITATION IN THE PROJECT AREA VARIES BY ELEVATION WITH A MEAN RATE OF APPROXIMATELY 22 INCHES PER YEAR, MUCH OF WHICH FALLS AS SNOW IN THE WINTER. LANDFORMS IN THE WATERSHED ARE A MIX OF ALPINE RIDGES, LOW RELIEF ROLLING HILLS, WET MEADOWS, ALLUVIAL VALLEYS AND COLLUVIAL CANYONS. THE WATERSHED IS 65 PERCENT FORESTED AND CONSISTS PREDOMINANTLY OF CONIFERS AND GRASSLANDS. UPPER SPOTTED DOG CREEK SUPPORTS RESIDENT NATIVE FISH INCLUDING WESTSLOPE CUTTHROAT TROUT (ONCORHYNCHUS CLARKI LEWISI) AND VARIOUS OTHER AQUATIC SPECIES.

THE PROJECT AREA IS CHARACTERIZED BY DISTURBED CONDITIONS FROM GRAZING, IRRIGATION DIVERSIONS AND DECREASED BEAVER ACTIVITY. NON-MAINTAINED BEAVER DAMS HAVE BEGUN TO FAIL AND ARE CONTRIBUTING TO CHANNEL ENTRENCHMENT AND A LOSS OF WETLANDS AND RIPARIAN VEGETATION. GRAZING HAS SUPPRESSED RIPARIAN VEGETATION GROWTH AND CONTRIBUTED TO STREAMBANK INSTABILITY AND EROSION. AS A RESULT OF THESE IMPACTS, STREAM HABITAT CONDITIONS ARE IMPAIRED. EXISTING HABITAT CONDITIONS ARE CHARACTERIZED BY ELEVATED WATER TEMPERATURES FROM LACK OF SHADE, EMBEDDED SUBSTRATE FROM BANK EROSION AND LOW COMPLEXITY FROM LOSS OF POOLS AND INSTREAM WOODY DEBRIS.

UPPER SPOTTED DOG CREEK STREAM CHARACTERISTICS

DRAINAGE AREA	13 SQUARE MILES
MEAN ANNUAL PRECIPITATION	22 INCHES
FOREST COVER	65% FORESTED
BASEFLOW DISCHARGE	< 1 CFS
BANKFULL DISCHARGE	45-50 CFS
25-YEAR DISCHARGE (4% EXCEEDANCE)	126-175 CFS
VALLEY GRADIENT	0.022 FEET/FEET
STREAMBED D50	1-INCH GRAVEL
STREAMBED D84	2-INCH GRAVEL
EXISTING STREAM TYPE	F4 AND C4
PROPOSED STREAM TYPE	E4 AND C4

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EXISTING CONDITIONS

UPPER SPOTTED DOG CREEK
NEAR AVON, MONTANA

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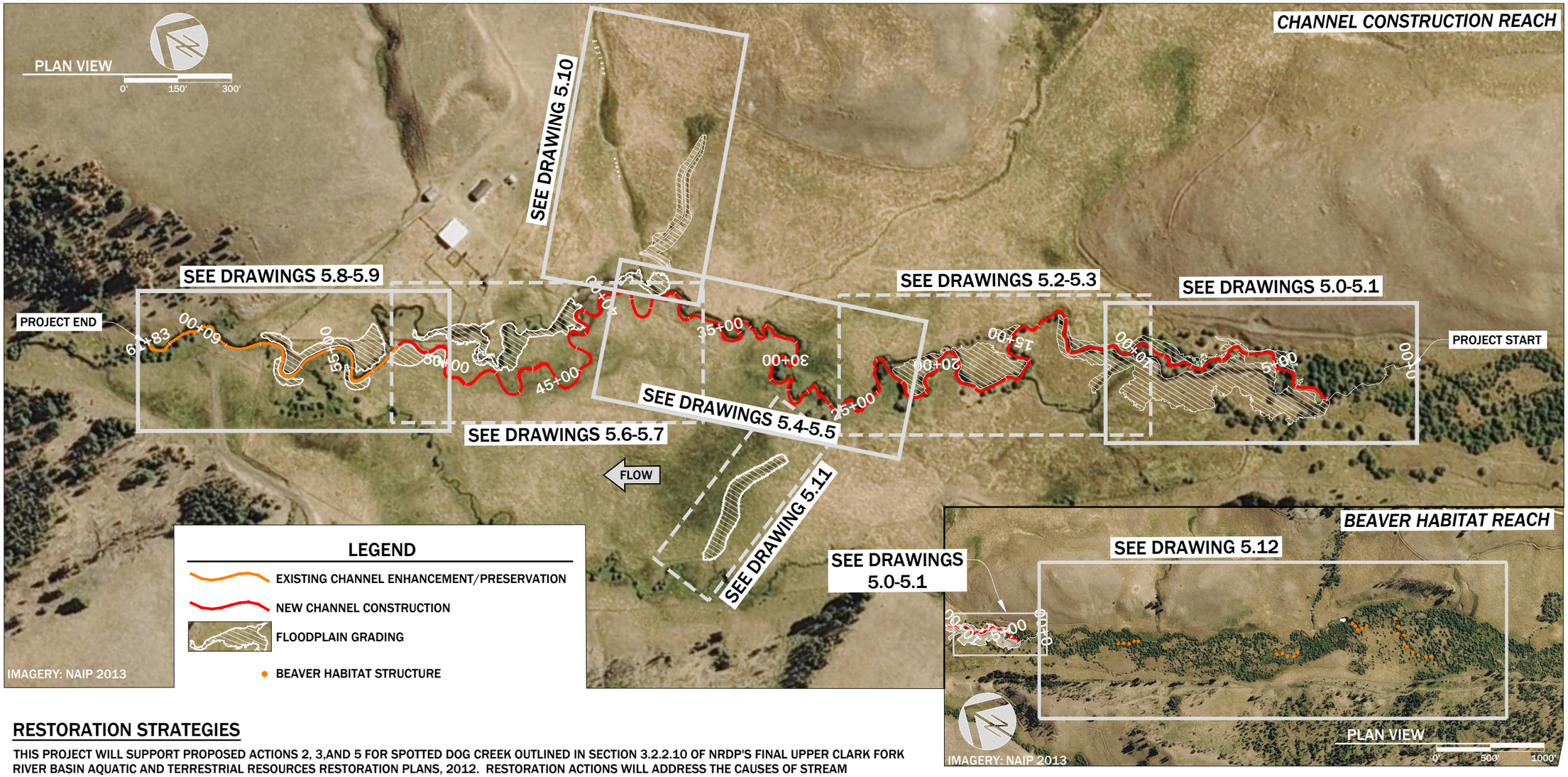
SHEET NUMBER
2.0



RESTORATION STRATEGIES

THIS PROJECT WILL SUPPORT PROPOSED ACTIONS 2, 3,AND 5 FOR SPOTTED DOG CREEK OUTLINED IN SECTION 3.2.2.10 OF NRDP'S FINAL UPPER CLARK FORK RIVER BASIN AQUATIC AND TERRESTRIAL RESOURCES RESTORATION PLANS, 2012. RESTORATION ACTIONS WILL ADDRESS THE CAUSES OF STREAM IMPAIRMENT BY MANAGING GRAZING IMPACTS, ESTABLISHING SUSTAINABLE STREAM MORPHOLOGY AND IMPROVING RIPARIAN VEGETATION CONDITIONS.

GRAZING IMPACTS WILL BE ADDRESSED THROUGH IMPROVED RIPARIAN FENCING AND FENCE REPAIRS. STREAM MORPHOLOGY WILL BE ADDRESSED BY REDUCING CHANNEL ENTRENCHMENT THROUGH CHANNEL GEOMETRY MODIFICATIONS AND FLOODPLAIN RECONNECTION; INCREASING CHANNEL SINUOSITY THROUGH PLANFORM RE-ALIGNMENT; AND IMPROVING SUSTAINABILITY BY ESTABLISHING POOL-RIFFLE MORPHOLOGY AND STREAMBANK VEGETATION. RIPARIAN VEGETATION WILL BE ADDRESSED BY IMPROVING FLOODPLAIN CONNECTION, INCREASING FLOODPLAIN TOPOGRAPHIC COMPLEXITY AND BY PLANTING DIVERSE RIPARIAN VEGETATION COMMUNITIES. STREAMBANK TREATMENTS WILL BE INSTALLED TO ADDRESS SHORT TERM STABILITY AND TO PROMOTE THE ESTABLISHMENT OF STREAMBANK VEGETATION.

AQUATIC HABITAT OBJECTIVES	VEGETATION OBJECTIVES	GEOMORPHIC OBJECTIVES
INCREASE SHADE TO REDUCE WATER TEMPERATURES	RESTORE FLOODPLAIN CONNECTION	REDUCE CHANNEL ENTRENCHMENT TO IMPROVE FLOODPLAIN CONNECTION AND PROMOTE WATER STORAGE
IMPROVE STREAMBANK COVER AND INCREASE WOODY DEBRIS	INCREASE WOODY VEGETATION COVER AND PLANT COMMUNITY DIVERSITY	REDUCE FINE SEDIMENT FROM SEVERE BANK EROSION
MAINTAIN DEEP POOLS THAT PROVIDE REFUGIA DURING LOW FLOW	MANAGE GRAZING IMPACTS	ESTABLISH SUSTAINABLE MORPHOLOGY AND PROMOTE DYNAMIC EQUILIBRIUM
MAINTAIN CLEAN SUBSTRATE	MANAGE WEEDS	PROMOTE BEAVER ACTIVITY AND EVOLUTION OF THE SITE TO WETLAND COMPLEXES

RESTORATION ACTIONS

RESTORATION ACTIONS INCLUDE WORK ON APPROXIMATELY 80 ACRES OF THE VALLEY BOTTOM. BEAVER HABITAT STRUCTURES COMPOSED OF WOODY DEBRIS, ALLUVIUM AND WILLOW CUTTINGS WILL BE CONSTRUCTED AT 20 LOCATIONS IN THE UPPER END OF THE PROJECT AREA. BEAVER HABITAT STRUCTURES WILL BE USED TO REDUCE CHANNEL ENTRENCHMENT, INUNDATE THE VALLEY BOTTOM AND PROMOTE RIPARIAN VEGETATION DEVELOPMENT. CHANNEL RESTORATION WILL ADDRESS APPROXIMATELY ONE MILE OF DEGRADED STREAM CHANNEL. CHANNEL RESTORATION ACTIONS WILL INCLUDE A COMBINATION OF EXISTING CHANNEL PRESERVATION, EXISTING CHANNEL ENHANCEMENT, CHANNEL RE-ALIGNMENT TO ABANDONED FORMER CHANNELS, AND NEW CHANNEL CONSTRUCTION. CHANNEL RESTORATION ACTIONS WILL BE ACCOMPANIED BY SELECTIVE FLOODPLAIN GRADING AND BANK RE-SLOPING. CHANNEL RESTORATION WILL RESULT IN 6,000 LINEAR FEET OF IMPROVED AQUATIC HABITAT AND STREAM FUNCTION.

CONSTRUCTED STREAMBANKS WILL BE TREATED IN SELECTED LOCATIONS WITH SOD/BRUSH STREAMBANK STRUCTURES AND WOODY DEBRIS STRUCTURES. SOD/BRUSH BANKS CONSIST OF LAYERS OF TRANSPLANTED SOD, BRUSH AND WOODY VEGETATION CUTTINGS. WOODY DEBRIS STRUCTURES CONSIST OF LOGS AND BRUSH. CONSTRUCTED FLOODPLAIN SURFACES WILL BE ROUGHENED AND STABILIZED WITH MICROTOPOGRAPHY GRADING AND LARGE WOOD PLACEMENT. CONSTRUCTED FLOODPLAIN SURFACES WILL ALSO BE ENHANCED WITH TOPOGRAPHIC DIVERSITY CONSISTING OF WETLANDS, FLOODPLAIN SWALES AND BURIED WILLOW FASCINES. FORMER STREAM CHANNELS WILL BE PLUGGED WITH EXCAVATED SOILS AND CONVERTED TO FLOODPLAIN FEATURES AND WETLANDS. APPROXIMATELY 1,800 CONTAINERIZED PLANTS WILL BE INSTALLED ON THE NEW FLOODPLAIN SURFACE.

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RESTORATION PLAN
UPPER SPOTTED DOG CREEK
NEAR AVON, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
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3.0

TOTAL WOOD QUANTITIES

ITEM	QUANTITY	DIAMETER	LENGTH	ROOTWAD
LARGE LOGS	50	12-18 IN	8-10 FT	YES
MEDIUM LOGS	20	6-12 IN	8-10 FT	YES
SMALL LOGS	3,600	3-6 IN	8-10 FT	OPTIONAL
BRUSH	7,180	1-3 IN	8-10 FT	OPTIONAL
CUTTINGS	17,700	0.75-1.5 IN	6-8 FT	NO

TOTAL ROCK QUANTITIES

ITEM	QUANTITY	GRADATION		
		SIZE (INCHES)	PERCENT PASSING	REPRESENTATIVE SIZE CLASS
STREAMBED FILL	940 CY	8	100	D100
		4-6	90-100	D95
		2-4	50-80	D65
		1-2	30-50	D35
		0.5-1.0	10-30	D15
		FINES	0	
CATEGORY 1 ROCK	940 EA			

EARTHWORK QUANTITIES

ITEM	QUANTITY (CY)
EXCAVATION	6,371
BACKFILL	3,192
HAUL EXCESS TO REPOSITORY	3,179

SOD AND BRUSH BANK QUANTITIES

ITEM	QUANTITY
SOD BRUSH BANK	3,540 LF
SMALL LOGS	3,540 EA
BRUSH	7,080 EA
CUTTINGS	17,700 EA
SOD	21,240 SF

BEAVER HABITAT STRUCTURE QUANTITIES

ITEM	QUANTITY
BEAVER HABITAT STRUCTURES	20 EA
STREAMBED FILL	200 CY
SMALL LOGS	120 EA
BRUSH	200 EA
CUTTINGS	200 EA

LARGE WOOD QUANTITIES

ITEM	QUANTITY
LARGE WOOD STRUCTURE	10 STRUCTURES
LARGE LOGS	50 EA
MEDIUM LOGS	20 EA
SMALL LOGS	60 EA
BRUSH	100 EA

RIFFLE QUANTITIES

ITEM	QUANTITY
CONSTRUCTED RIFFLE	2,350 LF
STREAMBED FILL	940 CY
CATEGORY 1 ROCK	940 EA

FLOODPLAIN ROUGHNESS QUANTITIES

ITEM	QUANTITY
FLOODPLAIN ROUGHNESS	3.4 AC
SMALL LOGS	170 EA
BRUSH	510 EA

PLANTING AND SEEDING QUANTITIES

ITEM	QUANTITY
PLANTS	1,800
WEED MATS	1,800
BROWSE PROTECTORS	1,800
BROADCAST SEEDING	4.0 AC
SHRUB SALVAGE	±200 EA
SOD SALVAGE	1.6 AC
WILLOW TRENCH	600 LF
CUTTINGS FOR WILLOW TRENCH	3,000 EA

FENCING QUANTITIES

ITEM	QUANTITY
BARBED WIRE FENCE	24,240 LF
TREATED WOOD POSTS	404 EA
FENCE NAILS	1,616 EA

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PROJECT MATERIALS AND QUANTITIES

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NEAR AVON, MONTANA

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